A PROGRAM PARTICIPANT SURVEY OF THE CONSERVATION RESERVE PROGRAM IN OKLAHOMA

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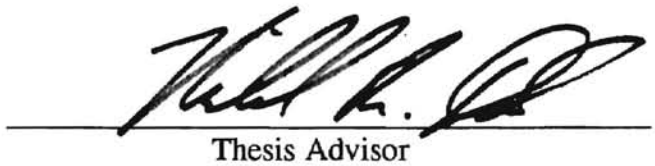

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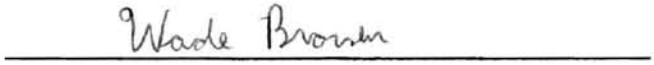

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CHAPTER I

OVERVIEW

Introduction

The Conservation Reserve Program (CRP) was authorized in the Conservation Title, Title XII, of the Food Security Act of 1985 (FSA) and is a long-term land retirement program administered by the United States Department of Agriculture (USDA). The CRP was designed with the primary objective of reducing water and wind erosion on highly erodible croplands. In exchange for annual payments, CRP participants remove highly erodible croplands from production and place the land in an approved, permanent, soil-conserving cover crop.

When CRP contracts expire land owners may return the land to crop production, leave it in the permanent cover, or use the land for some other agricultural or non-agricultural purpose. No stipulations are made as to post-contract use of CRP land, other than those acres which will be subject to conservation compliance. Conservation compliance, legislated by the Food Security Act of 1985, is a stipulation that all highly erodible land must be used according to an approved conservation plan in order for a producer to receive USDA commodity program benefits for that land. Acknowledging the importance of this issue, Congress authorized a study of post-CRP land use in the

Food, Agriculture, Conservation and Trade Act of 1990 (FACTA). This research examines post-CRP land use decisions by contract holders in Oklahoma.

History of Agricultural Policy

United States legislation has almost always been conscious of agricultural production concerns. Agriculture has been used as a tool for economic growth, development, and stability in the United States. The first federal land use policies, The Land Ordinances of 1785 and 1787, promoted agricultural expansion and settlement of land. The Homestead Act of 1862 gave fee simple title to U.S. citizens filing on certain 160-acre tracts of land. The Organic Act of the Department of Agriculture of 1862 authorized the Department of Agriculture and its various agencies for the purpose of "acquiring and diffusing among the people of the United States useful information on subjects connected with agriculture and rural development, in the most general and comprehensive sense of, and to procure, propagate, and distribute among the people new and valuable seeds and plants" 7 U.S.C., § 2201.

The first policies of the newly created Department of Agriculture had priorities of encouraging the expansion and growth of the agricultural sector, using development, regulatory, and stabilization policies. The previously mentioned Homestead Act and the land run of 1890 encouraged expansion while the establishment of the USDA and the passage of the Morrill Act (1862), the Hatch Act (1887), and the Smith-Lever Act (1914) provided much needed technical assistance to farmers. Through the agencies and institutions set up by these acts, scientific methods were skillfully applied to

agriculture and silviculture. However, the economic depression of the 1920's and 1930's slowed economic growth and agricultural expansion. As a result, federal policies were authorized that aided citizens with employment, income, and price support measures. To aid agricultural producers, the Agricultural Marketing Act was passed in 1929. This act symbolized the end of expansionary agricultural policies and introduced the use of compensation and stabilization policies to American agriculture (Dicks et al., 1990). It was during this time, the period of the Dust Bowl, that a new priority was introduced to domestic agricultural policy -- resource conservation.

As a result of this new priority in policy, the efforts of early conservationists began to bear fruit. The re-establishment of forests and grasslands was funded by Congress and the issue of resource conservation was made the primary concern of the newly established Soil Conservation Service (1935).

History of Conservation Policy

In early 1935 when extensive droughts darkened the nation's skies with huge clouds of soil, the United States Congress began work on the Soil Conservation and Domestic Allotment Act. This act was the first of its kind to establish soil and water conservation as national policies. The groundwork for a national conservation policy had previously been laid with the passage of the Federal Reserve Act of 1891, the Clarke-McNary Act of 1924 and the Taylor Grazing Act of 1934. The Soil Conservation Act of 1935 and the Flood Control Act of 1936 quickly followed.

In the years since 1935, conservation of natural resources has not been a major focus of agricultural policy. It has instead been incorporated into farm policy when agricultural surpluses mount and then given less emphasis when supplies become tight. Environmental policy has only recently been consistently integrated into agricultural policy (Hallberg).

Conservation and environmental policy focuses on preserving natural resources for current and future uses and ensuring that the environment is kept clean and available for the purposes society deems desirable. Recently, the continued push for a national resource conservation and environmental policy has been undertaken by several national and regional environmental, wildlife, conservation, legal, forestry, and agricultural groups who energetically work to develop a unified agriculture and resource conservation agenda. The vast amount of lobbying, research, and publicity work done by such organizations has heightened America's awareness of conservation and resource issues and resulted in the inclusion of the first specific conservation titles in the 1985 and 1990 Farm Acts.

In his agricultural policy text, Hallberg asserts that all policy decisions have a direct effect on the well-being of every member of society and, to some extent, policy decisions have lasting effects on future generations as well. In light of this, the new priorities for agricultural policy coordinate with the long term goal of extended use, productivity, and enjoyment of our natural resources. These priorities include conservation of natural resources, preservation of wildlife and fish habitats, increased

soil productivity, reduced off-site water pollution, maintenance of a diverse natural environment, and continued production of agricultural products. Another strong argument for the inclusion of soil erosion and resource conservation measures in national policy lies in the fact that a large amount of erosion costs are external to the farm and are thus borne by all of society. These costs include sedimentation of streams and waterways, fertilizer and pesticide run-off, and loss of exposed topsoil. These costs are lasting and continuous as farmers intensify crop production without implementing soil conservation measures (Halcrow). Justification for publicly funded agricultural policy was well stated in the 1993 Update to the Renewable Resources Planning Act:

> "American society in the 20th century changed from rural and agrarian to urban and industrialized. Although this change has been accompanied by a corresponding physical and psychological separation of people from the land and resources, today's urbanized nation is no less dependent on the products of its forests and fields than were the subsistence farmers of America's past."

The United States has a total land area of approximately 2.26 billion acres. In 1987 active and idled cropland and cropland used for pasture comprised about 20 percent or 464 million acres, 29 percent was forested, 26 percent was in other grassland or range, and the remaining 25 percent was in nonagricultural uses (USDA Statistics). Land use nationally and across regions has remained fairly constant since the 1960's, contradicting the often voiced concern that prime agricultural land is disappearing as urban centers expand. In fact, land for nonagricultural and non-forest uses grew at a compounded annual rate of only 1.01 percent between 1949 and 1987 (USDA Statistics).

Although the land resource available to agricultural producers is quite stable, society is mandating that agricultural and forest land be used in a resource conserving manner. Land repeatedly disturbed in the cropping process has an increased propensity for soil loss. Therefore, producers must be especially aware of cropping system alternatives and the likelihood of erosion with each system. Important tools used by conservationists and agriculturalists alike in combating soil erosion and resource depletion include no- and low-tillage cropping systems, less intensive cropping systems, filter strips along stream banks, wind breaks between fields, removal of highly erodible lands from crop production, and planting of trees.

Acknowledging the need for soil conservation and resource protection, the United States government and several of its agencies aid, and in some instances require, agricultural producers in establishing and maintaining conservation practices and systems. These efforts are encouraged through government programs which provide technical and/or financial support.

The Conservation Reserve Program

Congress authorized the Conservation Reserve Program (CRP) to address the joint problems of environmental quality and surplus crop production. The first congressional authorization of the CRP occurred in the Food Security Act of 1985 (FSA). The program was slightly reorganized and continued in the Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA).

The goals of the CRP were (Young and Osborn):

1) enroll 40-45 million acres of highly erodible cropland, with 12.5% of those acres to be planted to trees
2) protect the land's ability to produce food and fiber,
3) reduce sedimentation of waterways,
4) improve water quality,
5) foster the growth of wildlife habitat,
6) curb the production of surplus commodities, and
7) provide income support for farmers.

Agricultural producers voluntarily enrolled eligible land in 10 year contracts that required the land to be placed in a permanent, soil-conserving cover. Acceptable cover practices include native grasses, introduced grasses, tree plantings, wetland trees, contour grass strips, and wildlife food plots. CRP participants (land owners or operators) received an annual per-acre rent for the acres enrolled and half the cost of establishing the cover crop.

To participate in the CRP program, eligible participants offered acreage to the government at a specific price or bid. If the bid was accepted the contract holders were guaranteed annual per acre payments for the length of the contract along with fifty percent cost-share assistance for the establishment of a soil conserving cover crop on the contract acres. The contract holder was responsible for maintaining the cover crop and any commercial use of the land was prohibited, except under declared emergency

conditions. The CRP was, to some extent, patterned after the 1956 Soil Bank program.

Nine sign-ups were held during the tenure of the FSA. A total of 33.9 million acres were enrolled, with the majority enrolled in the Great Plains and Mountain states. An increase in the rate of program enrollment occurred as a result of the corn bonus which was offered to offset the incentives available to participants in the Paid Land Diversion program. The bonus was only offered during the fourth sign-up and resulted in a large enrollment of highly erodible acres in the Corn Belt region.

The Food, Agriculture, Conservation, and Trade Act of 1990 reauthorized the CRP as a land retirement program but reorganized the bid process and assigned new priorities to the program. The new priorities were designed to allow more precise selection of acreage to achieve environmental rather than just soil loss goals. The standard program bids were evaluated based on the ratio of a land's environmental benefits index (EBI) to the government cost of the contract. The EBI measures the potential contribution of each contract to the new set of conservation and environmental goals. The new set of goals outlined in the 1990 authorization include: improvement of surface and ground water quality, preservation of soil productivity, income support to farmers most affected by conservation compliance, enrollment of sites in established conservation priority areas and Hydrologic Unit Areas, and increased acreage enrollment for tree planting.

Three additional CRP sign-ups have been held under the FACTA authorization. As a result of the new acreage acceptance criteria, enrollment in sign-ups 10 and 11 was quite different from that obtained in the previous nine sign-ups. 32 percent of the land accepted was from the Northern Plains, Southern Plains, and Mountain Regions contrasting with 62 percent for sign-ups 1-9. As of the twelfth sign-up, June 1992, 36.5 million acres were enrolled in the CRP contracts.

Justification for Proposed Research

When CRP contracts expire landowners may return the land to crop production, leave it in permanent cover or use the land for some other agricultural or non-agricultural purpose. Approximately 74 percent of CRP land is highly erodible and will be subject to conservation compliance (Dicks, 1987). Conservation compliance provisions require that an approved conservation plan be followed in order for highly erodible land to be eligible for USDA commodity program benefits.

The impact of CRP land returning to production will depend on USDA commodity program rules and economic conditions present when contracts expire. In addition, the quantity, quality and location of land returning to production will depend on several factors, many of which cannot be controlled by congressional and administrative policy makers. As a result, projections of recropping rates and economic and environmental impacts of recropping are made with uncertainty.

Despite the uncertainty of projections about post-contract CRP land use, possible recropping patterns should be explored in order to provide a foundation for discussion regarding the fate of CRP land. Knowledge of the characteristics of contract holders controlling post-contract use of CRP land as well as other factors likely will aid in understanding possible use of CRP land.

Proposed Research

The objectives of this study are:

(1) to determine the socioeconomic, demographic, and farm size and ownership characteristics of Oklahoma CRP contract holders; and

(2) to identify factors that influence the probability of CRP acres being recropped.

Objective (1) will be accomplished using descriptive statistics to categorize responses from a survey of Oklahoma CRP participants. The survey was mailed to 5 percent of Oklahoma CRP contract holders. As of the eleventh sign-up, Oklahoma had 8,575 contracts representing almost 1.2 million acres enrolled in the CRP.

Univariate probit analysis will be used to accomplish objective (2). Probit analysis results in probability estimates of the dependent variable, in this case the probability of a certain CRP acre being recropped following CRP contract expiration.

CHAPTER II

REVIEW OF LITERATURE

Economic and Environmental Assessment of the CRP

Several authors have estimated economic impacts of the CRP. However, most of these studies have estimated costs and benefits of the program based on the then current enrollment numbers and a full program enrollment of 40-45 million acres and many regional estimates were calculated based on the enrollment patterns of the first nine sign-ups. These figures now require updating since, as stated earlier, enrollment through sign-up twelve was only 36.5 million acres, 3.5 million acres less than the lowest enrollment goal and the regional enrollment patterns shifted in the last three sign-ups. Although the CRP is authorized to enroll 40-45 million acres through 1995, no funding was appropriated for additional sign-ups in 1993 and funding is not likely for 1994. As a result, the CRP may not reach its enrollment goal before a new farm act is legislated in 1995.

Expected economic effects of the CRP include decreased total crop production, higher commodity prices, decreased production costs, government supply control cost-savings, program administrative costs, and diminished economic activity in rural areas where

enrollment is heavy. An expected environmental benefit is the decrease in soil loss and associated improvement in water quality, decreased particulate matter in the air, and increasing future soil productivity. Also, the decreased crop production should lead to decreased use of agricultural chemicals.

There is no exact method for measuring the total social benefits and the total social costs of the CRP. The economic and environmental benefit and cost measures of several authors are presented here.

Young and Osborn studied the effects of the CRP on farm income, land values, exports, consumer costs, government costs and impact on national income. The simulations were conducted using FAPSIM and were augmented with natural resource data bases and CRP enrollment data through the first six sign up periods. A primary assumption was made that if the CRP had not been implemented commodity programs would have been the same as under current law. Also two projections were used. First, one scenario projected large commodity price increases would occur after 1992. The second scenario assumed that prices would not rise after 1992. The difference in the two scenarios resulted in the ranges listed. The production adjustment attributed to the CRP was found to increase farm income by $9.2 - 20.3 billion in present value between 1986 and 1989, a gain of $60 - $100 per acre in the value of land available for the CRP. Consumer costs were found to increase by less than 1% with the maximum increase occurring in 1995. The total program cost estimated in present value was $25.2 billion. Although costs to the government were estimated at $21.5 - $22.8

billion, most of the costs were expected to be off-set by savings in USDA commodity programs ($16.2 - $19.5 billion). The net present value of benefits for a 45 million acre CRP were estimated to be $3.4 - $11.0 billion.

Young and Osborn conducted an economic assessment of the program comparing effects from implementation of a 45 million acre CRP with a baseline scenario characterized by the absence of the CRP. The authors assumed that if the CRP had not been implemented other agricultural programs would have been the same as under the then current law.

Following this assumption, the authors found the CRP to yield net economic benefits between $3.4 billion and $11.0 billion[1]. Farm income was estimated to rise by $9.2-$20.3 billion between 1986 and 1999 from projected increased commodity prices and lower production costs. Those landowners who planted trees as the cover crop, an estimated 3.5 million acres, will have an estimated $4.1-$5.4 billion gain in wealth.

Young and Osborn estimated environmental benefits to be between $6.0-$13.6 billion with these benefits occurring largely in off-farm areas affected by agricultural soil sedimentation. The value of improved water quality ranged from $1.9-$5.3 billion, wildlife benefits were $3.0-$4.7 billion, wind erosion abatement benefits were $0.4-

[1]These estimates reflect an estimated 45 million acre CRP and are stated in 1990 present value; based on projections of supply, demand and prices over most of the 10 year contract period.

$1.1 billion, and soil productivity benefits were estimated to be $0.8-$2.4 billion. Government direct costs from a 45 million acre CRP were estimated to be between $21.5-$22.8 billion which was estimated to be partially offset by a $16.2-$19.5 billion decrease in Government payments to farmers. Consumer food costs were estimated to climb by $12.7-$25.2 billion over the life of the CRP.

Moulton et. at. (1989) found that the productive activities associated with the harvest of CRP timber would induce greater economic activity than the economic activity associated with haying or grazing. While the economy-wide effects in the first 10 years after establishment of the CRP cover crop are similar for timber and grass production, once tree stand thinning begins economic activity in the timber regions increases. The effects of the timber harvesting activities continue to increase the economic well-being of the timber producing communities until the final harvest takes place, 30 to 40 years later. In the Delta and Southeast, which are major timber producing regions, overall activity in all economic sectors reached or surpassed pre-CRP levels.

Ribaudo calculated three natural resource benefit estimates for the cropland retirement occurring under the CRP. This study analyzed three different enrollment scenarios: a baseline scenario, with the same enrollment pattern as exhibited through 1987; a forestry scenario, where the program is redirected to encourage enrollment in areas where trees tend to be planted as an approved cover crop; and an environmental scenario; where the program is redirected to encourage retirement of environmentally

sensitive lands. Regional environmental benefits associated with CRP participants were then estimated under each scenario for changes in soil productivity, water quality, air quality, wildlife habitat, and groundwater quality. The author found that the CRP generates large total and per-acre benefits under all three scenarios examined. But the benefits varied by region and by scenario.

The forestry scenario changed the enrollment patterns to achieve Congress's goal of tree coverage on 12.5% of all acres in the remaining sign-ups. This procedure results in 10 percent tree coverage if the CRP were to reach 45 million acres. Under this scenario the amount of land enrolled in eastern regions is projected to increase, with the Southeast and Lake States nearly doubling the amount of acres enrolled under the baseline. In regions where forestry is not as competitive with agriculture (e.g. Corn Belt, Great Plains and Mountain regions), acreage enrolled is projected to decrease under the forestry scenario.

Ribaudo estimated total "best guess" natural resource benefits from the baseline scenario to be approximately $10 billion, total benefits from the forestry scenario to be $11 billion, and total benefits from the environmental scenario to be $10.6 billion. The additional benefits for the forestry and environmental scenarios were attributed to improved water quality and wildlife habitat. These additional benefits occur because the scenarios enroll additional land mainly from the regions east of the Mississippi river where higher concentrations of population and industry result in a higher value being placed on water quality and natural resources.

The four regions having the greatest natural resource benefits from the forestry scenario were the Lake States ($3.4 billion), the Corn Belt ($1.6 billion), the Southeast ($1.2 billion), and the Delta States ($1.1 billion). It should be noted that the two regions with the largest amount of benefits to natural resources are not the regions with the most tree coverage on CRP lands. The Southeast and Delta States regions contain 83% of all CRP tree plantings.

The productive activities associated with the harvest of the timber planted in the CRP induce greater economic activity than those associated with haying and/or grazing. Ribaudo found that the effects of the CRP in the first 15 years after the establishment of the cover crop are similar for timber and pasture production areas. Once commercial thinning of the timber stands begins the economic activity in the timber regions increases. These projections are similar to those made by Moulton et. al. The effects of the timber harvesting activities continue to increase the overall economic well-being of the timber producing communities until the final harvest occurs. In each of the three timber producing regions, economic activity over all sectors, except the agricultural production and input supply sectors, reached or surpassed pre-CRP levels.

In their review of the CRP, Ervin and Blase sought to analyze the potential impacts of the program on supply control and government costs. Their analysis of available information suggested that the result of the CRP would be to substitute the longer term conservation reserve for the short term set aside and paid diversion measures. In their discussion of the CRP impact on farm prices, they utilized Dicks' analysis which

estimated that by 1990 soybean, wheat, and corn prices would increase 11, 10, and 2 percent, respectively, over levels without the CRP. Ervin and Blase also identified three potential effects on government cost. Land retirement under the CRP was projected to have the potential for reducing commodity program expenditures as acreage bases fell, crop prices rose, and stocks declined, reducing deficiency payments and other program costs. Governmental costs would increase with rental payments and cost sharing for cover establishment. Quoting estimated rental costs at $40-$50 per acre and $30 per acre of shared cover establishment costs, they estimated a first year conservation reserve expenditure of $70-$80 per acre. The third cost addressed was the cost of reallocation of staff time and expenditures by local, state and federal government agencies in implementing and monitoring the program. The authors' greatest criticism of the program is the prohibition of commercial forage use on enrolled land. This prohibition was shown to increase rental payments, acting as a limiting factor in the permanent transition of highly erodible land to less intensive uses and a reduction in community economic activity and tax base in areas of high CRP enrollment.

Dicks (1987) looked at the criterion upon which the success of the CRP is to be judged, made preliminary estimates on net benefit or net cost of the program and discussed areas within the program that could be changed in order to improve the economic efficiency of the program. Dicks emphasized the importance of analyzing the CRP by its benefit-to-cost ratio. Under the assumption that the two primary objectives of the program are to reduce erosion and control supply, the author calculated that these two

objectives provided $40 in benefits for every $56 in cost. Three recommendations for improvement of the economic efficiency of the program were made: allow for acceptance of acreage posing an environmental effect; adjust rental caps to better represent the individual areas; and use a multiple objective criterion to select bids.

Ervin and Blase sought to identify the potential impacts and problems of the CRP on erosion control and environmental benefits. The lack of accountability for off-site effects from soil erosion was criticized and attributed to the short implementation process caused by budget pressures. The primary concern of the authors was the risk that the enrolled land will return to crop production without erosion control upon contract expiration.

Lovejoy used a national model to obtain estimates of the CRP impact on water resources. A series of scenarios was created for the CRP and the conservation compliance provision in which the water quality impacts of each of these scenarios were estimated. Changes in erosion and loadings of suspended solids, nitrogen and phosphorus associated with the change in land use were estimated. The scenario simulating 1990 cropping patterns, which assumed a 45 million acre CRP enrollment but without conservation compliance in place, resulted in overall reductions of 35 percent in the nation's gross erosion rate. When conservation compliance was imposed in addition to the 45 million acre CRP, a 44 percent reduction in gross erosion resulted.

Powell, Hickman, and Williams selected case farms in northeast, south central, and southwest Kansas in their analysis of the economic impacts of conservation compliance. The costs of implementing various practices to meet conservation compliance provisions and of losing program benefits were analyzed. In northeastern Kansas all the conservation practice options necessary to meet conservation compliance requirements resulted in a loss of net returns compared to current production practices including government programs. However these options yielded greater net returns than farming in violation of the conservation compliance. Because of higher yields and low conservation costs in south central Kansas, most conservation practice options resulted in higher net returns than current practices. In southwestern Kansas all the conservation practice options had higher net returns than producing in violation of the conservation compliance provision. The conservation options with the highest net returns were those using reduced tillage and enrolling low-yielding, highly erodible land in the CRP.

Dicks, Hyberg and Hebert estimated the impact of the CRP on national, regional, state and local economies. The analysis measured the reduction in crop production, the reduction in associated agricultural input and output industries and the reduced demand for goods and services providing support to these agricultural industries. The results indicated that the CRP reduces total gross output and employment during the three unique stages of the program (cover establishment, full implementation, and program termination) at the national, regional and local economic levels. The reduction in output nationally was 3 percent and as high regionally as 20.9 percent in northeastern

Montana. Northeastern Montana also experienced employment declines of 21.4 percent. The economic impact in agriculturally dependent rural areas such as Montana was much greater than those estimated for urban areas.

Broomhall and Johnson estimated the economic impacts of the Conservation Reserve Program in east-central Georgia where most of the CRP land has been planted to trees. The calculations were made over a forty year period that was divided into five stages. Stage one, the first year, removed the costs and profits from agricultural production and included establishment costs and rental payments. During stage one the CRP had a $16 million negative annual impact. Stage two, 2-10 years, removed establishment costs and included a maintenance cost of $2.50 per acre annually. During stage two the CRP again had a negative annual impact of $18.1 million. Stage three, 11-20 years, removed the rental payments received and a negative annual impact of $26.5 million was estimated. Stage four, 21-25 years, includes timber harvest, harvest costs and annuity income. During stage four the authors estimated an annual increase of $48.2 million. Stage five, 26-40 years, includes only annuity income and has an estimated negative annual impact of $13.3 million.

Kraft, Roth, and Thielen performed a cluster analysis using data from a survey of farmers in southern Illinois. Survey respondents were separated based on the nature of their operations. Farmers ranked the goals for their operation. Soil conservation was selected as the first goal by only 1.8% of the sample population. The results indicated that financial growth, survival, and maintenance of rural life style were the three most

important goals of those surveyed. The results also indicated that in order to most effectively promote soil conservation, linkage with financial incentives such as those in the Conservation Reserve Program will be necessary.

Sanders summarized the bid results in Oklahoma through the first three bid periods and evaluated the economic effects of the CRP. The bid results showed 422,000 acres of cropland in Oklahoma enrolled in the CRP with an average bid of $41 per acre. The greatest amount of acreage enrolled, 59 percent, was in the Panhandle region, 24 percent of the enrolled acreage was in the southwest region, 12 percent in the north central region, and 4 percent in the eastern region. The average size of the contract was 165 acres. Wheat accounted for 51 percent of all CRP contract acres and the data indicated a 5-10 percent reduction in Oklahoma's wheat production as a result. Sanders also compared annual net per acre returns with and without conservation compliance and for the CRP. The results indicated that farms similar to those used in the analysis would be better off participating in a government commodity program or the CRP. However, the results also predicted that without program payment increases the cost of compliance could cause net returns to fall by as much as 10-30 percent.

Landowner Decision, Participation, and Recropping Studies

Force and Bills studied the factors influencing CRP participation in central and western New York. The two primary objectives were to analyze the CRP participation decision among farmers and to differentiate between farmers and nonfarmers. The factors evaluated in their relationship to the participation decision included: the influence of the

presence of dairy income, existence of soil conservation practices, farm size, annual nonfarm income greater than $5,000, ownership of highly erodible cropland, hard-to-farm land, and the relationship between bid cap levels, cash rents and preservation of base acreage. Of those surveyed, 50% of the CRP participants were nonfarmers by the author's definition (more than $5,000 nonfarm income annually). Farmers with eligible cropland who were also dairy farmers were found to be less likely to participate. The lower rate of participation by dairy farmers was attributed to the long term lease arrangements restricting the option of an alternative feed source. Participation was increased by the presence of hard-to-farm land, the presence of off-farm income, and ownership of a large farm. Increases in enrollment in New York could be achieved by greater regional specialization. Suggestions included reduction of the 10 year enrollment requirement and raising the bid cap on land that is both highly productive and highly erodible.

An estimate of recropped acreage on post-CRP contract lands was made by Barbarika. The author compared the economic returns from future uses of CRP lands, estimated land use impacts of neither enrolling additional lands, renewing existing contracts, nor taking any other specific direct actions to continue protection of CRP acreage as contracts expire. Table I presents a summary of estimated recropped CRP acreage.

TABLE I.

Estimated Recropped Acreage, Erosion Changes and Non-Conservation Complying Acreage on Post-CRP Contract Land, for Contracts Expiring 1996-1999.[a]

Region	Acreage Recropped	Reduction in Erosion Above T[b]	Acreage Recropped w/o Conservation Plans[c]
		(Percent)	
Northeast	38	69	53
Appalachian	67	57	44
Southeast	8	81	51
Delta States	30	62	49
Corn Belt	76	53	47
Lake States	67	73	17
Northern Plains	60	78	34
Southern Plains	62	78	10
Mountain	48	83	4
Pacific	39	82	26
Totals	57	72.5	30

[a] Source: Barbarika, 1994. pg. 8.

[b] Post-CRP erosion levels compared with pre-CRP and pre-conservation compliance erosion levels.

[c] As a percentage of all recropped, highly erodible lands.

According to Barbarika, results show that approximately 57 percent of CRP acreage will be returned to crop production nationwide and about 30 percent of recropped highly erodible CRP acreage would be used to produce crops without conservation plans. However, there are some differences in crop production across regions that should be noted. The Southeast has a very high reduction in soil erosion even though

half of all recropped acres will not have a conservation plan. This erosion savings is due to the large number of tree acres. Minimal soil loss occurs on acres planted to trees because the soil is not continually tilled and disturbed as in a cropping situation Barbarika estimated that annual soil erosion would increase over current CRP levels, but erosion above T (the soil loss tolerance level or the rate at which soil can replenish or rebuild itself naturally) would be 73 percent lower than pre-CRP levels.

A statewide study in North Dakota by Mortensen et. al. evaluated the land attributes and landowner characteristics of CRP participants. Of the participants surveyed, 62 percent were over the age of 55. The average gross farm income was $94,000, 20 percent lower than the average reported for all producers statewide. The CRP income exceeded net cash farm income for 41 percent of the producers, and 21 percent of the respondents reported that the program enabled them to keep farming. The land enrolled was, on the average, 9.5 percent less productive than other land not enrolled. The contract payments were found to be 6.7 percent higher than the cash rents.

Bultena, Lasley, and Hoiberg surveyed Iowa farm operators in 1988 in their study of participation and perceptions of the CRP in Iowa. Approximately 26 percent of the farmers with eligible cropland were participating in the program, and 90 percent of the non-participants had no plans to bid acres into the program. Over 80 percent of the CRP participants enrolled at least half of the total cropland acreage and 43 percent enrolled all of their highly erodible croplands. Large and more capital intensive farms were disproportionally enrolled in CRP. However, measured as a proportion of

eligible acres enrolled, no significant relationship was found between farm size and enrollment. Awareness of the CRP was relatively high with 70 percent of those surveyed considering themselves informed about the program. The survey also measured attitudes toward the CRP and found the more negative farmers' attitude toward government involvement in agriculture the less likely they were to be signed up in the CRP. Also, the greater the awareness of needed plans for erodible land the higher the rate of participation.

Skaggs, Kirksey, and Harper surveyed New Mexico CRP contract holders to determine post-CRP land use intentions. Using a multinomial logit model, the authors tested the hypothesis that post-CRP land use intentions vary with acreage enrolled in the CRP, the availability of irrigation resources, participant's age, and off-farm employment. Participant age was hypothesized to be associated with higher probabilities of post-CRP cropping intentions because of resource fixity and risk aversion. The authors further hypothesized that the presence of irrigation prior to CRP enrollment would increase the probability of post-CRP crop production intentions because of the high opportunity value of the water resource.

Results indicated that participant's knowledge of grass variety is more indicative of grazing intention as opposed to a cropping intention, as is the participant's interest in permanent crop base retirement. Participants who enrolled in the CRP because of a desire to reduce soil erosion also were more likely to indicate an intention to put land

into grazing use. Size of acreage holding in CRP was negatively associated with a grazing intention and positively associated with cropping intentions.

Hatley, Ervin and Davis surveyed CRP participants from eleven Texas counties in a study of how the following six socioeconomic factors relate to CRP participants: organizational structure, age, education, occupation, tenure, and size of holding. The only factor not found to be significant was the organizational structure. In a comparison of age groups, farmers over 65 had participation levels higher than the general population and those younger than 44 had participation levels less than the general population. Education was found to play a role in participation level. Farmers with less than 8 years of education had lower rates of participation and those who had completed 12 years or more had higher rates of participation. Landowners with full ownership were found to have higher rates of participation. Size of holding only affected one group. Those with less than 139 acres were found to be under-represented in the CRP.

CHAPTER III

SURVEY RESULTS

Introduction

Oklahoma is a Great Plains state characterized by semi-arid grazing lands and winter wheat production. Hard red winter wheat production in Oklahoma is unique in that the wheat can be grazed in the winter and early spring without any noticeable effects on wheat grain yield. This unique enterprise makes the production decisions faced by Oklahoma farmers and ranchers more complex than those in other regions. In turn, this production option makes more complex the factors influencing land-use decisions and enrollment in long term land-use programs, such as the CRP.

The CRP in Oklahoma

As of the eleventh sign up (July 1991), Oklahoma had retired nearly 1.2 million acres of cropland to the CRP with a total of 8,575 contracts. The average contract size is 140 acres and the average rental rate is $42.48 per acre per year. The CRP represents an annual source of almost 51 million dollars in income to Oklahoma farmers. Average erosion savings from Oklahoma CRP land are 23 tons per acre per year. Also, 950,137 crop base acres were placed in escrow as a result of enrollment in the CRP.

Crop base acres placed in escrow retain their commodity program eligibility when CRP contracts expire.

Oklahoma CRP Survey Background

The survey used in this research was conducted during early spring 1993. Oklahoma CRP contract holders were surveyed to obtain information concerning their intentions for their land once CRP contracts expire. The mail survey and the survey process is described below. A sample survey is included in the appendix.

A sample of CRP contract holders was obtained from the Agricultural Stabilization and Conservation Service (ASCS). A total of 430 (5 percent sample) contracts were selected by choosing every 20th contract. Because some contracts listed joint contract holders, 613 surveys were mailed out. No additional contact was made with the survey recipients.

180 surveys were returned, representing 53,203 CRP acres. This 38 percent survey response represents 2 percent of all Oklahoma CRP contract holders and 4.4 percent of all Oklahoma CRP acres. When more than one survey response was received, as a result of some contracts specifying joint contract holders, the surveys were coded to respond to the same contract and all surveys were entered. Multiple surveys were received for 14 contracts. The percent response statistic for each question was calculated as the number of responses to the respective question divided by 180 (number of useable survey responses). Some questions allowed multiple responses by

each respondent which resulted in the percent response not summing to 100 for that question.

Survey respondents were asked to answer some initial questions regarding ownership and control of the CRP acres represented by the contract number shown on the survey instrument, but to respond to the remaining survey questions in regards to all CRP land owned or operated by them. With respect to CRP enrollment, survey respondents were asked to provide information on enrollment date, reason for enrolling, and interest in extending their CRP contract under various scenarios as well as a permanent CRP contract.

Information on farm size and type was collected through questions about the size of operation in both CRP and non-CRP acres, acres rented, and acres owned. Respondents were asked to estimate gross income from all sources, the percentage of gross income from non-farm sources, and the percentage of gross farm income from each production enterprise.

An important aspect of CRP contract holder research is the correct prediction of the post-CRP land use intentions of contract holders. To assist in developing these predictions, respondents were asked to estimate the number of acres expected to be returned to crop and livestock production, type of production, equipment requirements and/or livestock inventory changes necessary to facilitate land use changes and the associated expected cost. Questions were also asked to determine which factors are

likely to influence post-CRP land use decisions and/or constrain the desired use of CRP land.

Information on conservation practices was gathered through questions regarding the number of acres in conserving use, specific conservation practices employed, and the cost of establishing a conservation cover. Respondents were also asked if they were familiar with the conservation compliance requirements for their land, if they have a conservation plan for their farm, and the cost expected to meet these requirements.

Summary of Oklahoma Survey Responses

As Table II illustrates, the typical Oklahoma CRP contract holder is the owner and operator of the CRP land and will be involved in the land use decision once CRP contracts expire. Having a large percentage of survey respondents involved in the post-contract land use decision is important to this research. In situations where the contract holder returned a survey yet is not the land operator or in instances where there were joint contract holders returning a survey yet only one contract holder is making the land use decisions, survey responses may not accurately reflect the actual land use decision. Therefore, having the respondents indicate if they will or will not be involved in the post-contract land use decision is crucial to using this information to determining factors influencing post-contract land use.

TABLE II.

Survey Respondent Characteristics

	% Response
Owner/Operator of CRP Contract Land	61.7
Owner/non-Operator	20.0
Operator/non-Owner	12.2
No Response	6.1
Respondent will be involved in post-CRP land use decision	87.2
No Response	12.8

Land owner and farm operator socioeconomic data were obtained for survey respondents. Farm operator age and education level information was compared with Oklahoma state statistics obtained from the 1989 Oklahoma Agricultural Statistics publication and results from a 1990 Oklahoma farmer survey (Sanders).

The average age of CRP survey respondents (61) is a full 10 years older than that of Oklahoma farmers as a whole. This age difference is important when considering the likelihood of CRP land re-entering production. If advanced farm operator age is combined with personal retirement as a factor influencing CRP enrollment (Table IV), those acres might be less likely to return to production.

Education level of CRP survey respondents is comparable to levels obtained in the 1990 Oklahoma farmer survey. Over half of those responding to the question had completed at least some college or vocational school training.

The primary objective of the CRP is the reduction of water and wind erosion on highly erodible cropland.. Nearly two-thirds of survey respondents (62.7 percent) indicated that their concern for soil erosion was an important factor in influencing CRP enrollment.

TABLE III.

Survey Respondent Knowledge of
Conservation Compliance Plan

	YES (Percent)	NO (Percent)
Are any CRP acres subject to compliance?	37.2	17.8
Are you familiar with compliance requirements?	25.0	8.9
Do you have a conservation plan on your land?	77.2	9.4

While only one-third (37.2 percent) of survey respondents indicated having acres subject to conservation compliance requirements, more than three-fourths (77.2 percent) have a conservation plan on their farm. The conservation compliance provision was designed to provide a permanent continuation of conservation practices on CRP acres. Nationally, compliance will affect approximately two-thirds of all CRP acres (Dicks, 1987). There is a large discrepancy between the number of persons who reported having a farm conservation plan and those who reported having CRP acres subject to compliance. This could possibly be a result of farm enrollment in a program or programs other than CRP which require a farm conservation plan. Conservation plans are required by the Agricultural Conservation Program (ACP) and the Great Plains Conservation Program (GPCP). Both programs have large enrollments in the

Great Plains region. However, the discrepancy between the number of persons that reported having a farm conservation plan and those who reported that their CRP acres subject to compliance could indicate that many contract holders are unaware that their CRP acres will be subject to compliance when the contracts expire.

TABLE IV.

Factors Influencing CRP Enrollment

	Most Important	Somewhat Important
	Percent of Respondents	
Concern for Soil Erosion	37.2	25.5
Most Profitable Use of Land	38.3	15.0
Low Risk Associated with CRP Payments	22.8	17.2
Reduced Labor Requirements	10.5	19.6
Provision of Wildlife Habitats	11.1	17.8
Easiest Way to Meet Compliance Requirements	12.2	13.3
Personal Retirement	10.5	9.4

Table IV shows the responses to a question regarding participants' reason(s) for enrolling in the CRP program. When the most important and somewhat important response percentages are summed for each factor, concern for soil erosion is the most common factor (62.7 percent) that respondents indicated influenced their CRP enrollment decision. The next two most common responses are most profitable use of land (53.8 percent) and low risk associated with CRP payments (40.0).

These responses are interesting when compared to the responses reported by Kraft et. al. In their survey of Illinois CRP contract holders only 1.8 percent of respondents

indicated soil conservation concerns were an important consideration in determining cropping practices. The different style of questioning does not allow for direct comparison of the results.

Dicks and Coombs compared "reason for enrollment" responses given by CRP participants in Oklahoma, Kansas, Missouri, and North Dakota. The responses compared were the responses to questions where survey respondents indicated reasons that were at least somewhat important in their decision to enroll in the CRP.

When the responses were compared, a concern for soil erosion was the most often indicated reason for enrollment for respondents in Missouri, Kansas and Oklahoma. The three reasons indicated by the most respondents in each state are summarized below.

Oklahoma: soil erosion, most profitable use of land, low risk associated with payments

North Dakota: low risk associated with payments, soil erosion, provision of wildlife habitat

Kansas: soil erosion, most profitable use of land, low risk associated with payments

Missouri: soil erosion, most profitable use of land, low risk associated with payments, provision of wildlife habitat (the latter two reasons had almost identical number of responses)

Respondents to the Oklahoma survey used in this research were asked to predict post-CRP land use (Table V). The majority of respondents plan to use their CRP acres for pasture or hay, yet less than half indicated they will return land to livestock production once contracts expire. The intention to use the CRP land for pasture or hay production and not to engage in a livestock enterprise would lead one to assume program participants plan to lease out their land. Yet fewer than 3 percent of respondents indicated having the intention to rent or lease out their land.

TABLE V.

Predicted Post-CRP Land Use

	% Response	No Response
Pasture or Hay for Livestock	59.4	40.6
Row Crop/Small Grain Production	25.5	74.5
Row Crop/Small Grain Production w/ Haying or Grazing	21.7	78.3
Idle Grass/Trees w/ no Haying or Grazing	19.4	80.6

Almost half, 47.8 percent, of respondents indicated wheat will be the crop produced once CRP contracts expire. Oklahoma is well suited to winter wheat production with winter and spring livestock grazing. The fact that only 25.5 percent of farmers plan to return acreage to row crop/small grain production, and nearly half plan to plant wheat, is indicative of the importance of wheat pasture for the Oklahoma livestock industry. The sum of respondents returning land to row crop/small grain production and row crop/small grain production with some haying/grazing is 47.2 percent which is almost equal to those who indicated wheat as the crop to be produced. Of course sorghum,

corn and cotton would also be included in the row crop/small grain category. The total percent of respondents indicating some type of row crop/small grain production was 71.6.

If, in fact, CRP contract holders follow through with their intentions as indicated and plant a large number of wheat acres, but don't increase livestock numbers accordingly, then it could be reasoned that Oklahoma grazing land rates will decrease as a result of increased pasture availability. These responses are not weighted by acres; therefore, 71.6 percent of the respondents indicating a return to some type of row crop/small grain production does not necessarily correlate to 71.6 percent of the acres. For a more correct analysis of the acres returning to crop production once CRP contracts expire, the responses to this survey question would need to be weighted by acres. When the survey data is used to run the univariate probit model used later in this research, the survey responses are indeed weighted by acres (see Chapter IV.)

Table VI presents the responses of survey respondents as to which factors are expected to influence row crop and/or small grain production plans. Producers indicated low crop prices and high variable costs of production as factors most likely to influence cropping plans. Lack of experience in conservation practices was the factor least considered to influence crop production.

TABLE VI.

Factors Which May Influence Row Crop
and/or Small Grain Production Plans

	Most Important	Somewhat Important
	Percent of Respondents	
Low Crop Prices	27.8	15.5
High Variable Production Costs	22.2	12.2
Low Land Yields	15.0	14.4
Cost of Maintaining Crop Program Eligibility	11.7	12.8
Lack of Experience in Conservation Practices	1.1	3.9

Producers were also asked to indicate which factors are expected to interfere with livestock production (Table VII). Inadequate fencing and high investment required to begin production were indicated as being the greatest barriers to livestock production. However, if inadequate fencing and inadequate water supply are grouped together as a barrier to livestock production, then 56.1 percent of respondents indicated this as being a most or somewhat important barrier.

TABLE VII.

Factors Which May Interfere with
Post-CRP Livestock Production

	Most Important	Somewhat Important
	Percent of Respondents	
Inadequate Fencing	14.4	20.0
Inadequate Water Supply	10.6	11.1
High Investment Required for Production	17.2	18.9
Inexperience in Livestock Production	1.7	5.6
Lack of Profits in Livestock Production	13.3	10.6

Survey respondents were asked to indicate different sources of gross farm income and the percentage of gross farm income received from each source. A summary of the responses is presented in Table VIII. Most respondents indicated CRP payments as a source of gross farm income, which is not surprising considering only CRP contract holders were surveyed. However, this number does not equal the total number of respondents because some respondents were not contract owners or were only partial owners who might not receive any portion of the payments.

The gross farm income responses can be further summarized by production type. Doing so results in 99 responses for all types of livestock production, crop production is second with 70 responses, and third was hay production which was indicated as a source of income by only 15 respondents.

TABLE VIII.

Survey Respondent Sources Of
Gross Farm Income

Source of Gross Farm Income	Number of Responses	Did Not Respond
CRP Payments	124	56
Cow/Calf Production	66	114
Cash Grain Production	61	119
Other Government Payments	51	129
Stocker Calf Production	31	149
Hay Production	15	165
Rent/Royalties	10	170
Cotton Production	9	171
Custom Harvesting and/or Haying	5	175
Other Livestock Production	2	178

Table IX summarizes the survey responses to four different CRP contract extension scenarios. On each of the scenarios, less than 20 percent of the respondents indicated they would extend the contract under the given scenario. However, nearly half of the respondents indicated they would be interested in a permanent CRP contract. In addition, nearly 20 percent of the respondents indicated that they would maintain an approved cover if base protection (even without a rental payment) were provided. Yet 5-10 percent of respondents clearly do not wish to return their land to cropland. These respondents favored some type of contract extension, and would consider alternatives.

There was a large degree of unsure responses on each extension scenario. These contract holders are probably delaying making a post-CRP land use decision until the 1995 farm bill and commodity programs are proposed. Also, these contract holders' decisions may depend heavily on the economic and price situation when contracts expire. Respondents were also asked to indicate a minimum annual payment which would be needed for them to enroll in a permanent CRP. The average response was $38.70, almost $4.00 per acre less than the state average annual per acre payment.

Across states, participant response to bringing CRP acreage back into production if contracts are not extended is mixed. The majority of participants expressed interest in some type of contract extension, but were not in agreement as to the type and method of extension. The estimates discussed in Dicks and Coombs were survey response percentages, not model estimates. Recropping of CRP land is likely to be based, in part, upon program crop legislation provisions governing use of crop base acres. These provisions differ to some degree in each farm act and are predicted by many authors to undergo significant structural changes in the next several years.

TABLE IX.

CRP Contract Renewal Scenarios

	% Response
Extend contract for 10 years at 50% of current contract rate with no haying or grazing.	
Yes	10.5
No	53.5
Unsure	15.0
No Response	21.0
Extend contract for 10 years at 25% of current contract rate and some haying and grazing.	
Yes	8.3
No	43.9
Unsure	21.7
No Response	26.1
Extend contract for 10 years at 50% of current contract rate if given the option of changing current vegetative cover to wildlife species.	
Yes	5.5
No	53.5
Unsure	13.9
No Response	27.1
Would not extend contract, but would maintain an approved vegetative cover if base history protection were allowed.	
Yes	19.4
No	20.0
Unsure	26.7
No Response	33.9
Would be interested in a permanent CRP contract.	
Yes	49.4
No	18.9
Unsure	14.4
No Response	17.3

Oklahoma is mostly rangeland and is suited to grass production. As expected, the overwhelming majority of CRP participants used some type of grass as a cover crop on their CRP acres with only 6.1 percent of respondents indicated planting trees on their CRP acres. Table X summarizes the types of grass cover crops planted by respondents. The most common grasses used were native species which are not difficult to establish. With the exception of bermuda grass, the native grasses used to establish a cover will offer little resistance to conversion to cropland.

TABLE X.

Grass Cover Planted On Oklahoma
CRP Contract Acres

Grass Species Planted on CRP Land	Percent Response
Native Mix	30.6
Plains Bluestem	23.9
Other Bluestem	15.6
Bermuda Grass	8.9
Lovegrass	6.7
Old World Bluestem	4.4
Other	5.0
No Response	12.0

Summary

When CRP contracts expire, program participants will have multiple choices for use of their contract land. The two most common production choices for Oklahoma land owners will be to return to crop production or to leave the land in grass cover for

livestock grazing and production. State policy makers, agricultural producers, and businessmen are all interested in the likelihood of land returning to each of the above production alternatives. Predictions of post-CRP land use are most reliable if based upon program participants' responses since they have the best knowledge of their own intentions.

CHAPTER IV

THEORY AND MODEL DEVELOPMENT

Introduction

Economic theory is mainly concerned with relations among variables (Kmenta). These relations can be in the form of supply and demand relations, cost functions, production functions and producer choices.

In social sciences, such as agricultural economics, regression analysis is often used to determine the relations between variables. Based on the Gauss-Markov theorem, regression analysis provides an estimator that has desirable statistical properties (Judge et. al.). When the assumptions of the Gauss-Markov theorem hold, ordinary least squares estimators (OLS) are best linear unbiased estimators and consistent. Multiple regression is appropriate when the model is extended to include more than one explanatory variable.

Procedures

When choice alternatives are limited, such as to recrop CRP acreage or not to recrop, the outcomes for economic variables are discrete or limited (Kmenta). Models that are used when a decision maker must choose from a limited set of alternatives are referred

to as models with qualitative dependent variables or "discrete choice models". These types of models violate the assumptions of the Gauss-Markov theorem, resulting in OLS estimators not being the best linear unbiased estimators.

The economic interpretation of discrete choice models is typically based on the principal of utility maximization leading to the choice of A over B if the utility of A exceeds that of B. The complexity of estimation and testing of models with qualitative dependent variables increases with the number of alternative choices. The simplest models are, those involving a binary dependent variable, with a value of 0 or 1 (Kmenta).

Linear Probability Model

The linear probability model can be used to represent a regression model with multiple observations on the dependent or choice variable Y. This model is a linear function of a set of explanatory variables. The model is:

1) $$Y_k = \sum_{i=1}^{N} \beta_i X_{ik} + e_k$$

where,

- Y_k can take on the values of 0 or 1 for the k^{th} observation,
- X_{ik} represents the k^{th} observation on the i^{th} explanatory variable,
- β_i is the parameter for the i^{th} explanatory variable, and
- e_k is an independently distributed random variable with zero mean

The linear probability model is flawed statistically for modeling discrete choice behavior (Griffiths et. al.). The error term variances differ across observations, which results in heteroskedasticity, and OLS estimation no longer provides the best linear unbiased estimator.

Probit Model

The probit model is a statistical model for discrete choice that is not linear in the parameters and achieves the objective of relating the choice variable Y to the set of explanatory variables. The probit model is based on the cumulative normal probability function and provides similar results to the logit model, which is based on the cumulative logistic probability function. The probit and logit models give similar results in the midrange, but the logistic function has slightly heavier tails than does the normal function (Kmenta). This difference in the functions does not matter much except in instances where data are concentrated in the tails (Griffiths et. al.).

The probit model can be used to translate values of X to predictions that lie in the (0, 1) interval. For example, let Y be the dependent variable for recropping CRP land. Y can assume two values, zero for not recropping and 1 for recropping. Assuming the k^{th} individual choice for Y^k is based on individual characteristics represented by X_k, a (1 x N) vector of explanatory variables, the probit model is

2) $$P_k^* = \phi\left(\sum_{i=1}^{N} \beta_i X_{ik}\right)$$

where,

P_k^* is the probability that the observation on Y for the k^{th} individual will equal one,

ϕ represents the cumulative distribution function of the standard normal,

X_{ik} represents the k^{th} observation on the i^{th} explanatory variable, and

β_i is the parameter for the i^{th} explanatory variable.

The probit model operates under certain assumptions. There cannot be a linear relationship between the independent and dependent variables, the Y's must take on a value of 0 or 1, the Y's should be statistically independent of one another, and there cannot be an exact linear relationship among the explanatory variables.

The interpretation of probit model estimates deserves comment. Estimated coefficients do not indicate the change in the probability of the event occurring given a one unit change in the corresponding independent variable. However, the sign of the coefficient does indicate the direction of the change. The magnitude of the change depends upon the steepness of the cumulative distribution function. Thus, the steeper the cumulative distribution function the greater the impact of a change in the value of an explanatory variable (Fomby et. al.).

Maximum likelihood estimation (MLE) methods can be used to estimate the probit model parameters. Under general conditions, MLE estimates are consistent, asymptotically normal and asymptotically efficient. Also since there is only one

observation on each decision maker, maximum likelihood methods must be used (Judge et. al.).

Model Development

A univariate probit models, weighted by acres, was specified and used to analyze survey question nine. The model was estimated using LIMDEP version 6.0 econometric software. LIMDEP uses the Newton method, also called the Newton-Raphson method, for estimation. The models have globally concave log-likelihoods, and estimation is generally routine. The Newton-Raphson procedure will ultimately converge to the unique maximum likelihood estimates regardless of the initial estimates (Fomby et. al.). LIMDEP begins probit estimation with OLS estimates.

Responses to the survey question which asked about respondent's plans for CRP land were used to create the dependent variable. This question was used for analysis because it dealt directly with respondents actual plans for CRP lands, if contracts were to immediately expire. The significance of weighting the responses by acres and the method used are discussed below.

> *If your CRP contract expired today, with the current prices and economic situation, indicate the number of acres currently in CRP that you anticipate will be converted to each category after CRP:*
>
> *Idle grass/trees without haying/grazing*
>
> *Pasture or hay for livestock*

Row crop and small grain production

Row crop and small grain production with haying/grazing

This question provides a "snapshot" look at respondent's post-contract intentions. It does not ask respondents to rank possible post-contract options nor does it provide differing post-contract scenarios. The wording of this question also allows respondents to indicate more than one alternative.

Note that the question asked respondents to respond in number of acres, resulting in a continuous variable, which would be unsuitable for a probit model. To account for this, the responses to question nine were grouped into two different subsets and each response was then coded with a 0 or 1 depending on which subset it was in. Since the objective of this research is to determine characteristics of an *acre* being recropped, the observations were weighted by the number of acres going to the respective cropping alternative. For those respondents indicating more than one cropping alternative, the entire observation was duplicated, assigned to the correct subset and weighted by the acreage amount. Surveys with a non-response for the question were eliminated from the model data set.

During computation, LIMDEP scales the weights so that they sum to the current sample size. The variable itself is not changed. For the variable *acres*, the variable is weighted as follows:

3) $$W_i = [N/\Sigma_i Z_i] \times Z_i$$

where,

W_i is the weight applied to the i^{th} observation

N is the number of observations

Z_i is acres in the i^{th} observation

The group one model subset contains all observations for which the respondent indicated he/she would *idle grass/trees without haying/grazing* or *pasture or hay for livestock.* These responses were coded with a 0 for use in the model. The group two subset contained all responses for which the respondent indicated *row crop and small grain production* or *row crop and small grain production with some haying/grazing.* These responses were coded with a 1 for use in the model.

Economic theory and previous research identifies several significant characteristics of recropped CRP land, as well as characteristics associated with recropping intentions of contract holders.

CHAPTER V

RESULTS

Introduction

The probability of an acre being recropped is hypothesized to be a function of physical location, land tenure, whether or not a desire for personal retirement influenced CRP enrollment, CRP sign up period, percent of farm enrolled in CRP, land capability classification, gross income, education level and age. The model for probability of an acre being recropped is specified as follows.

$$4) \quad \begin{aligned} RECROP = {} & \alpha + \beta_1 * REG1 + \beta_2 * REG2 + \beta_3 * REG3 + \beta_4 * TENURE \\ & + \beta_5 * RETIRE + \beta_6 * SIGNUP + \beta_7 * PERENROL + \beta_8 * LNDCL2 \\ & + \beta_9 * LNDCL3 + \beta_{10} * LNDCL4 + \beta_{11} * INCOME + \beta_{12} * EDUC + \beta_{13} * AGE \end{aligned}$$

All variable information was obtained from the Oklahoma CRP participant survey described previously unless otherwise specified.

Where:

RECROP is 1 if the survey respondent indicated the acreage would be recropped, zero otherwise.

TENURE is 1 if the respondent is the operator of the CRP contract land, zero otherwise.

REG1 is 1 if the CRP contract was located in Oklahoma region 1, zero otherwise. Thirty-nine responses were located in this region. (See Figure 1 for region definitions.)

REG2 is 1 if the CRP contract land was located in region 2, zero otherwise. Thirty-three responses were located in this region.

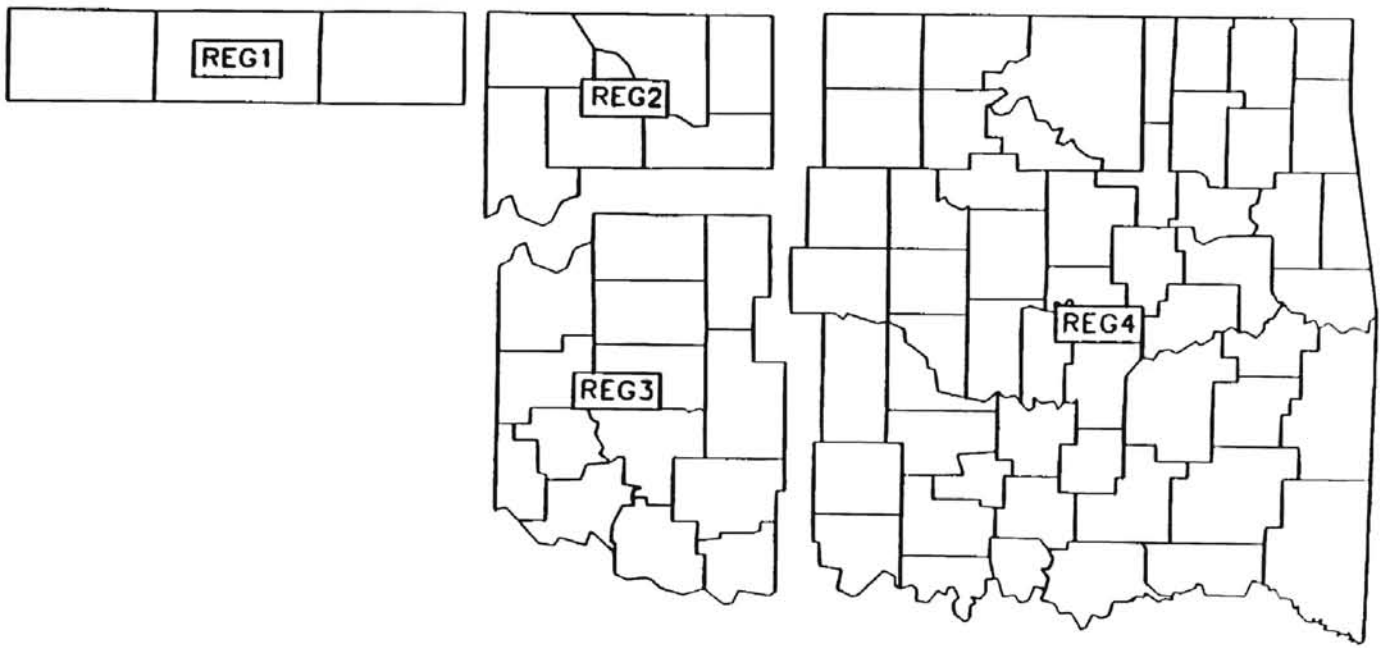
REG3 is 1 if the CRP contract land was located in region 3, zero otherwise. Forty-four contracts were located in this region.

RETIRE is 1 if respondent indicated that a desire for personal retirement was either most or somewhat important in their decision to enroll in the CRP, zero if not important.

SIGN UP represents the sign-up period associated with each contract and was obtained from the ASCS data tapes.

PERENROL is the percent of the farm in CRP. It was calculated by dividing the number of acres accepted in the CRP contract by the farm size. Both acreage amounts were obtained from the ASCS data tapes.

Figure 1: CRP Contract Response Regions for "REG #" Set of Dummy Variables



LNDCL1 is the reference variable in the land class group of dummy variables. LNDCL1 is 1 if the contract land was classified as 2, 2C, 2S, 2W, 3, 3C, or 3S and zero otherwise. This variable represents the most productive land with few limitations to cultivation and the limitations were other than erosion. It is hypothesized that this land is most likely to return to production. The land class group of variables was obtained from the ASCS data tapes.

LNDCL2 is 1 if the contract land had a land capability classification of 2E or 3E, zero otherwise.

LNDCL3 is 1 if the contract land had a land capability classification of 4, 4S, 6C, or 7S, zero otherwise.

LNDCL4 is 1 if the contract land had a land capability classification of 4E, 6E, or 7E, zero otherwise.

INCOME is a value (1-8) representing the dollar amount of the respondent's approximate 1991 gross income from all sources with 1 indicating the lowest income level, zero for no response. The income categories were defined as follows: less than $20,000, $20,000 - $39,000, $40,000 - $59,000, $60,000 - $79,000, $80,000 - $99,999, $100,000 - $149,000, $150,000 - $199,999, $200,000 or more.

EDUC is a value (1-6) representing the highest level of education completed by the respondent with 1 indicating the lowest level of

education, zero for no response. The education levels were defined as follows: less than 11 years of education, high school graduate, some college completed, graduation from vocational institute and/or bachelors degree, some graduate work completed, or graduate degree.

AGE is the respondent's age in years.

It is hypothesized that an acre will have a greater probability of being recropped if the survey respondent is the operator, the respondent did not enroll in the CRP for personal retirement reasons, is in LNDCL1 or LNDCL2, and is in region 1 or region 2 of the state. Also, the probability of being recropped is hypothesized to be positively influenced by age, education level, percent land enrolled in the CRP, and sign up period. It is also hypothesized that the most highly erodible land went into the program in the first sign-ups; therefore, the later signups should have brought in the acres more likely to be recropped. In their survey of New Mexico CRP contract holders, Skaggs, Kirksey, and Harper found that younger participants were more likely to have grazing intentions and older participants were more likely to have cropping intentions. Gustafson and Hill found that, in North Dakota, older contract holders were more likely to lease their land when CRP contracts expire.

TABLE XI.

Weighted Univariate Probit Model Results

Variable	Coefficient	Weighted Mean	t-ratio
Constant	-3.1620		-2.0850
REG1	-0.3259	0.5210	-1.0720
REG2	*-0.9412	0.1255	-1.6960
REG3	-0.1358	0.1948	-0.2970
TENURE	*1.1072	0.8333	2.8120
RETIRE	*-0.6307	0.1847	-1.8630
SIGN UP	0.0580	3.9217	0.9450
PERENROL	-0.0020	64.1590	-0.4900
LNDCL2	0.6078	0.6892	0.4770
LNDCL3	0.9460	0.0216	0.6500
LNDCL4	1.3490	0.2706	1.0450
INCOME	*-0.1599	2.7040	-2.7640
EDUC	*0.1859	2.7190	2.7530
AGE	*0.1777	66.5060	2.1470

* Indicates variables significant at the 10 percent significance level.

Note:		
	Log-Likelihood	-85.5008
	Restricted Log-Likelihood	-106.5274
	Chi-Squared	42.05316
	Significance Level	.00006419

Evaluating the model results at the 10 percent significance level indicates that the variables REG2, TENURE, RETIRE, INCOME, EDUC, and AGE are significant. With the model specified as above and each variable evaluated at the respective weighted mean, a CRP acre has 37.4 percent probability of being recropped. However, using the weighted mean of the dummy variables is not precise since the

variables can be evaluated at two specific points, zero and one. Therefore, the probability of an acre being recropped was calculated with each dummy at 1 and also at zero, with all other variables at their weighted mean value. This allows for a comparison of the probability of being recropped given different variable situations. The results of those calculations are presented in Table XII.

TABLE XII.

Probability Of Recropping Given
Different Dummy Variable Values

Variable	Variable Value	Z Value[a]	P(recrop)[b] %
REG1	REG1 = 1	-0.232	40.800
REG2	REG2 = 1	-1.140	12.700
REG3	REG3 = 1	-0.335	36.900
REG4	REG4 = 1	-0.199	42.100
TENURE	TENURE = 0	-1.285	10.000
	TENURE = 1	-0.178	42.900
RETIRE	RETIRE = 0	-0.250	40.300
	RETIRE = 1	-0.877	19.000
LNDCL1	LNDCL1 = 1	-1.170	12.200
LNDCL2	LNDCL2 = 1	-0.559	28.800
LNDCL3	LNDCL3 = 1	-0.221	41.300
LNDCL4	LNDCL4 = 1	0.182	57.100

[a] Objective function value
[b] Probability of an acre being recropped

The numbers presented in Table XII are read as follows. The probability of an acre being recropped if it is located in the panhandle region of Oklahoma (REG1 = 1) is 40.8 percent, given all other model variables are at their weighted mean values with the

exception of the remaining three region dummies. These variables were set to zero since an acre cannot be in region 1 and at the same time in another region. Therefore, an acre has the greatest probability of being recropped if it is located in region 1 as opposed to being located in any other region of the state.

A comparison of the results from the TENURE or RETIRE (a dummy variable not part of an exclusive set) variable is as follows. If the survey respondent was the operator of the land then an acre has a 42.9 percent probability of being recropped. If the survey respondent was not the operator the probability of being recropped is 10.0 percent. Therefore, an acre has a 32.9 percent greater probability of being recropped if the survey respondent was the operator. Likewise an acre has a 23.1 percent greater probability of being recropped if the respondent did not enroll in the CRP for personal retirement reasons.

As shown in Table XII acres classified in LNDCL3 are more likely to be recropped than acres in the other three land capability classes. The land in LNDCL3 are acres classified as 4, 4S, 6C, or 7S. These are acres with productivity in the lower half of the capability classifications and limitations to production. The USDA recommends only limited cultivation on land class 4 and limited grazing, forestry or wildlife production on land classes 6 and 7. This land is not the most suitable for crop production. However, none of the land capability class variables were significant at the 10 percent significance level.

TABLE XIII.

Recropping Probabilities for Continuous Model Variables

Variable	P(recrop)[a]	Variable	P(recrop)
SIGN UP	2.17%	EDUC	6.9%
PERENROL	-.075%	AGE	.66%
INCOME	-5.97%		

[a] Probability of an acre being recropped

The negative sign on the INCOME variable coefficient is hypothesized to be explained by those respondents with higher income levels have a greater flexibility when evaluating production alternatives, specifically to recrop or not to recrop. This hypothesis is supported by the probability factor of -5.97% associated with INCOME. The interpretation is that if income increases one category the probability of an acre being recropped decreases by about 6 percent.

CHAPTER VI

SUMMARY

The objectives of this research were to (1) identify the socioeconomic, demographic, and farm size and ownership characteristics of Oklahoma CRP contract holders; and (2) identify factors influencing the probability of a CRP acre being recropped.

Objective 1 was accomplished by summarizing the results of a 1993 survey of Oklahoma CRP contract holders and were presented in Chapter III. In summary, 61.7 percent of the survey respondents indicated that they were the owner and operator of the CRP contract land, 87.2 percent of the respondents indicated that they will be involved in the post-CRP land use decision. As explained earlier, these two statistics are important to the usefulness of the survey data in determining characteristics of CRP land to recropped when contracts expire.

Nearly two-thirds of the survey respondents indicated that a concern for soil erosion was an important factor influencing their enrollment in the CRP, this response is consistent with the primary objective of the CRP which was to reduce water and wind erosion on highly erodible cropland. This finding differs from the finding of Skaggs, et. al., in their analysis of New Mexico CRP participants the authors found that only 27

percent of the CRP participants surveyed indicated a concern for soil erosion was a factor in their decision to enroll.

In Oklahoma, 47.2 percent of the respondents indicated that they plan to return to some type of row crop/small grain production when CRP contracts expire. This return to crop production could be indicative of a loss of the soil erosion savings resulting from the CRP. However, more than three-fourths of the respondents responded that they have a conservation plan on their farm and the Dicks et. al. study stated that conservation compliance will nationally affect approximately two-thirds of all CRP acres. These two statistics indicate that a fairly substantial amount of CRP land, if recropped, will be recropped in a manner to minimize soil erosion. Therefore, the environmental benefits of CRP may not be entirely lost if the land is recropped.

Perhaps the most important statistic found in the Oklahoma survey is the response to CRP extension scenarios (Table IX). On each of the contract extension scenarios presented, less than 20 percent of the respondents indicated they would extend the contract under any scenario. However, nearly half of the respondents indicated they would be interested in a permanent CRP contract. In addition, nearly 20 percent of the respondents indicated that they would maintain an approved cover if base protection (even without a rental payment) were provided and 5-10 percent of respondents clearly do not wish to return their land to cropland. These respondents favored some type of contract extension, and would consider alternatives.

Objective 2 of this research, identify factors influencing the probability of a CRP acre being recropped and significant characteristics of these acres, was accomplished through modeling the information gathered in the 1993 Oklahoma survey.

Model results indicate that an acre has the greatest probability of being recropped if it is located in Cimarron, Texas or Beaver counties (region 1), the survey respondent was the operator, the respondent did not enroll in the CRP for personal retirement reasons, the respondent has a lower level of income, high level of education, and advanced age.

Cimarron, Texas and Beaver counties are located in the Oklahoma panhandle and are large crop producing counties. So it is reasonable that CRP acres located in these counties would be likely to be recropped.

This research found that respondents with advanced age were more likely to recrop their acreage as opposed to younger respondents. This is consistent with the Skaggs, et. al. study which found that older CRP participants had higher recropping probabilities than younger participants. However, Brorsen, et. al. found that older CRP participants were less likely to recrop.

This research hypothesized that land classified in LNDCL1 or LNDCL2 would be most likely to be recropped. However, model results indicated that acres classified in LNDCL3 are more likely to be recropped than acres in the other three land capability

classes (Table XII). However, none of the land capability class variables were significant at the 10 percent significance level.

Policy Options

Of course the most obvious way to continue the program at lowest to taxpayers would be to select the single acre with the least bid rate and renew the contract. However, the above scenario is not what is usually desired when continuation of the CRP program is discussed.

To continue the CRP program with greatest environmental savings as the goal one could do several things. Perhaps the most straight forward method to maximize environmental benefits of contract renewal would be to select the acres with the greatest environmental savings and only renew those contracts. The only relevant environmental variable contained in this research is the set of land capability class variables. However, none of the land capability class variables ended up being significant in the results.

If continued crop production/supply control was designated as the goal for continuing the CRP program then one would want to target those acres **most** likely to be recropped. The logic being that acres not likely to be recropped can be assumed will stay out of production and would therefore not need to be enrolled in the program to prevent production from occurring. However, those acres most likely to be recropped would need to be enrolled to prevent crop production and thus meet the goal of

continued supply control. Several factors should be considered in addition to whether or not the acres are likely to be recropped. In this hypothetical scenario, it should be investigated if the targeted acres have crop base history associated with them. One may make a reasonable hypothesis that acres eligible for production, not hindered by compliance, and with established base would be very likely to return to production and might be designated as priority for contract renewal.

Limitations of Study and Recommendations for Further Research

In the course of this research several limiting factors were encountered, the most notable of which was the quality of information gathered with the survey instrument. The survey used in this research had been designed and mailed to respondents before the present research question was developed. This resulted in model design, variable sets, and estimation methods having to be specified after the fact. Because of this limitation several survey questions were not able to be incorporated into the model and potentially valuable information was lost.

Another limitation in this research and any survey response-based research is that model results are dependent upon returned responses. The survey responses are assumed to be correct and survey respondents are assumed to be knowledgeable of the contract land, production decisions, and land use intentions.

Also, survey question responses are dependent upon respondent's interpretation of the question. In a mail survey, such as the one used in this research, there is no personal communication with respondents so confusion regarding question intent is possible. This was observed on several questions where respondents were asked to estimated acres going to each category and instead responded with a "check". There were also several questions that asked for percentage of total responses which did not sum to 100. Any method employed to combat these limitations could result in better model estimations and could be justified.

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APPENDIX

OKLAHOMA STATE UNIVERSITY
FEDERAL FARM PROGRAM PARTICIPATION SURVEY

Please answer the following questions regarding Conservation Reserve Program contract Number _____

A. Are you the:

a. owner/operator

b. owner/non-operator

c. operator/non-owner

of this land?

B. If you are the operator, what proportion of acres in the above contract do you operate?

C. Are you likely to be involved in the land use decision when this contract expires?

Yes No

OKLAHOMA STATE UNIVERSITY
FEDERAL FARM PROGRAM PARTICIPATION SURVEY

We are conducting a survey of participants in the Conservation Reserve Program (CRP) in Oklahoma. The responses you provide will be treated confidentially and will in no way be associated with you personally. We would appreciate a few minutes of your time to help plan for the future of Oklahoma's natural resources. We carefully designed this survey to be uncomplicated and self-explanatory, but if you should have any questions or comments, please direct them to your local SCS District Conservationist.

DIRECTIONS: Please fill in the blanks, circle answers that apply or rank the level of importance for the following questions or statements.

Please answer the following questions regarding all land in CRP.

1. How many acres of land do you own or control that are enrolled in CRP? _____ acres

2. How many acres do you farm?
   Before CRP:
   _____ acres rented
   _____ acres owned
   Currently:
   _____ acres rented
   _____ acres owned

3. Under which sign-up did you enroll your CRP lands?

___	1. March 1986	___	7. July/Aug. 1988
___	2. May 1986	___	8. Feb. 1989
___	3. Aug. 1986	___	9. July/Aug. 1989
___	4. Feb. 1987	___	10. March 1991
___	5. July 1987	___	11. July 1991
___	6. Feb. 1988	___	12. June 1992

4. Under which sign-ups did you attempt to enroll but your offer was not accepted?

___	1. March 1986	___	7. July/Aug. 1988
___	2. May 1986	___	8. Feb. 1989
___	3. Aug. 1986	___	9. July/Aug. 1989
___	4. Feb. 1987	___	10. March 1991
___	5. July 1987	___	11. July 1991
___	6. Feb. 1988	___	12. June 1992

5. Why did you enroll in the CRP? For the most important reason, check **Most**. If the reason is important but not the most important, check **Some**. If the reason is not important, do not check.

	Importance Most	Some
Personal retirement	___	___
Reduced labor requirement	___	___
Concern for soil erosion	___	___
Most profitable use of land	___	___
Easiest way to meet conservation compliance requirements.....	___	___
Low risk associated with the payments.....	___	___
Provision of wildlife habitat.....	___	___
Other: _____...	___	___

6. Have you planted any trees on this CRP land?
   YES NO

7. What grass species have you planted on CRP acres? (ie. native mix, planes blue stem, jose tallweed, burmudagrass, etc.)
   _____

8. What cash expenses did you incur to establish grass cover on this contract? (total expenses)
   $_____

9. If your CRP contract expired today, with the current prices and economic situation, indicate the number of acres currently in CRP that you anticipate will be converted to each category after CRP:

Idle grass/trees without haying/grazing	_____ acres
Pasture or hay for livestock	_____ acres
Row crop and small grain production	_____ acres
Row crop and small grain production with some haying/grazing	_____ acres
Other: _____	_____ acres

10. If you return CRP acres to crop production, to what crops?

Wheat	____ acres	Sorghum	____ acres
Corn	____ acres	Alfalfa	____ acres
Cotton	____ acres		
Other: _____			____ acres

11. Will you need to make changes in your equipment inventory to implement the intentions given in Question 9?

	YES	NO
cattle equipment?	____	____
haying equipment?	____	____
cropping equipment?	____	____

If yes, what will it cost you to make these changes $_____.

If you plan to use additional custom hire services, estimate the cost $_____.

12. Do you plan to increase livestock numbers to implement the intentions given in Question 9?

YES NO

If yes, please indicate type of operation and number of head:

___	Cow/Calf.....	_____ head
___	Stocker.....	_____ head
___	Backgrounding.....	_____ head
___	Other:.....	_____ head
	_____	

13. What factors may influence your use of CRP land for row crop or small grain production after contracts expire? For the most important factor, check **Most**. If the factor is important but not the most important, check **Some**. If the factor is not important, do not check a box.

	Importance Most	Some
Low yields of the land.....	___	___
Low crop prices.....	___	___
Cost of conservation practices required to maintain eligibility for government programs.....	___	___
Lack of experience in conservation practices	___	___
High variable costs of production.....	___	___
Other: _____	___	___

14. What factors may interfere with your use of CRP land for livestock production? For most important factor, check **Most**. If the factor is important but not the most important, check **Some**. If the reason is not important, do not check a box.

	Importance Most	Some
Inadequate fencing.....	___	___
Inadequate water supply	___	___
High investment required for livestock.....	___	___
Inexperience in livestock production.....	___	___
Lack of profitability of livestock enterprises.....	___	___
Ground cover inappropriate for livestock	___	___
Other: _____...	___	___

15. Are you familiar with the conservation compliance requirements for your farm?

YES NO

16. Do you have a conservation plan on your farm?

YES NO

17. Are any of your CRP acres subject to conservation compliance requirements?

YES NO DON'T KNOW

18. What management practices will be required for your CRP acres to satisfy the conservation compliance plan?

Terraces ____ Windstrips ____
Residue Management ____
Other: _____

19. For CRP acres, what cash expenses do you expect to pay to meet conservation compliance requirements?
$_____/ACRE

20. Your approximate gross income from All Sources, including farm and nonfarm income, in 1991 was:

____ Less than $20,000
____ $80,000-$99,999
____ $20,000-$39,000
____ $100,000-$149,999
____ $40,000-$59,999
____ $150,000-$199,999
____ $60,000-$79,999
____ $200,000 or more

21. What percent of your gross income (indicated above) is from nonfarm sources? _____%

22. What percentage of your gross farm income comes from the following sources?

____ percent - Dairy
____ percent - Cow/Calf
____ percent - Stocker
____ percent - Cash grains
____ percent - Cotton
____ percent - Hay
____ percent - CRP payments
____ percent - Other Government payments
____ percent - Other _____
= 100 percent

23. How did you spend your CRP rental payment?

Percent of CRP payment spent for:	
Land debt retirement.....	____ %
Operating debt retirement	____ %
Non-farm investments and savings...	____ %
Additional livestock.....	____ %
Replace farm machinery & buildings.	____ %
New farm investments (except land) .	____ %
New farmland purchases.....	____ %
Family living, leisure.....	____ %
Property taxes	____ %
CRP land maintenance	____ %
Other: _____ ..	____ %
TOTAL 100%	

24. The highest level of education you have completed is:

____ Less than 11 yrs
____ Bachelors degree
____ High school graduate
____ Some graduate work
____ Vocational school
____ Graduate degree
____ Some college

25. When were you born? 19__

26. The following statements cover some possible policies dealing with CRP land. Please check your responses for each statement.

	YES	NO	DON'T KNOW
I would extend the contract for 10 years at 50 percent of current annual rental payment with no haying or grazing.	—	—	—
I would extend the contract for 10 years at 25 percent of current annual rental payment and some haying and grazing.	—	—	—
I would extend the contract for 10 years at 50 percent of current annual rental payment if given the option of changing current vegetative cover to wildlife species.	—	—	—
I would not extend the CRP contract, but would maintain an approved vegetative cover if base history protection were allowed.	—	—	—
I would be interested in a permanent CRP contract.	—	—	—

Minimum required annual payment $____/acre

27. Are you interested in receiving a summary of the results of this study?
YES NO

VITA

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